Bioengineering 208: Magnetic Resonance Imaging Laboratory
Winter 2007
Lab 1 Notes

1. **Calculate the excitation RF pulse waveform from a 2D gradient echo image.** Everybody got the idea but there was some confusion about the geometry. There are 2 ways to go about the deconvolution. 1) convert the profile from the image into blurred slice profile by dividing by tan(theta), then deconvolving with (thickness of tube / cos(theta). 2) deconvolving the image profile with (thickness of tube / sin(theta), then projecting onto the slice direction by dividing by tab(theta). Most people did a mixture of the two.
2. **Calculate a B_1 map from 2D gradient echo image data.** Everybody got the idea, but nobody tried part c. Since I asked for an order of magnitude estimate, almost any assumptions would be OK. For example, you could assume that the slice profile consists of two populations of tip angles, one at 0.8alpha and one at 1.2 alpha, and go through the calculation to see how much the answer differs from assuming that the whole slice is at 1.0alpha.
3. **Generate and analyze a quadrature artifact.** The image with quadrature ghost is decomposed into A(good image)+B(good image)*, where * denotes complex conjugate. The complex conjugate in k-space transforms into reflection through the origin in image space, or equivalently, rotation by 180°. If the good image has real and imaginary parts R and I, then when the imaginary part is cut in half: $R + 0.5jI = A(R + jI) + B(R - jI)$, thus $A + B = 1$ and $A - B = 0.5$, which has a solution A=0.75 and B=0.25.